Urinary Tract Infection

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Epidemiology

- UTI's are among the most common medical conditions.
  - *UTI is the second commonest outpatient disease after sore throat.*
- 50% of young women will have UTI. *(at least one episode in their life)*
- Recurrence in 1/3 of healthy women even though they have normal urinary tract.
- Incidence in men (<50 years) is 5-8 per 10,000 men annually.
- *You may have to treat your sister, mother and /or wife for UTI.*
- *Very common in female but rare in male.*

Definitions

- **Acute cystitis**: lower urinary tract infection.
- **Acute pyelonephritis**: upper urinary tract infection.

  UTI is classified into: complicated & uncomplicated (e.g. complicated acute cystitis)
- We call it Uncomplicated UTI *(simple), when there is*:
  - No physiologic or anatomical abnormalities of urinary tract.
  - No recent instrumentation *(e.g. folly catheter)* or urological surgery.

Categories of UTI

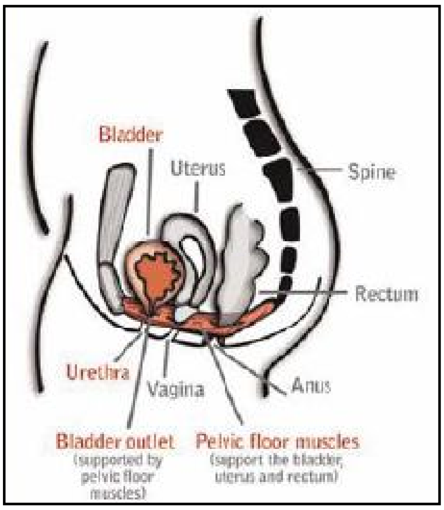
- *Majority - around 90% - of Pts with* UTI are young women *& usually present as:*
  - Acute cystitis.
  - Recurrent cystitis.
  - Acute uncomplicated pyelonephritis.
- *You can have:*
  - Acute uncomplicated cystitis in adult, *or*
  - Complicated urinary tract infection, *or*
  - Asymptomatic bacteriuria.

Pathogenesis

(why its common in women?)

All episode of UTI comes because of rectal flora & woman genitalia.
In woman genitalia :

1. *There is anatomical differences in urethra between sexes.*
2. *Perianal colonized with E.coli.*
3. *For bacteria, easy to migrate to reach bladder.*


Bladder
Uterus
Spine
Rectum
Urethra
Vagina
Anus
Bladder outlet (supported by pelvic floor muscles)
Pelvic floor muscles (support the bladder, uterus and rectum)

- Rectal flora colonizing distal urethra, will enter the bladder.
- Prevalence between men and women is different?
  - The greater distance between the usual source and of uropathogens and the urethral meatus.
  - The drier environment surrounding the male urethra.
  - Greater length of the male urethra.
  - Antibacterial activity of prostatic fluid.

NB
- ▸ Sphincters are the same in both sexes. So, not causing differences.
- ▸ Circumcised men are less developing UTI than non circumcised (important finding).

Etiologic Agents

- Uncomplicated urinary tract infection:
  - Gram-negative organisms 70-95%
    - E.Coli *(the commonest)*
  - Gram-positive organisms 5-20%
    - Coagulase-negative staph
- Complicated urinary tract infection *(still E.coli is the most common but chance of having another organism is high)*
  - Broad range of bacteria
  - E.Coli still the commonest organism
  - Citrobacter, Enterobacter spp, Pseudomonas, Staph aureus, enterococci

Urine test

By simple urine dipstick

Items are:

- Nitrite:
  - Screening for bacteriuria.
  - Relies on the ability of G –ve bacteria to convert nitrate to nitrite. *(urea splitting organism & this happen with gram –ve organism)*
  - *Some microbes (G +ve) that causing UTI, do not have capacity to change nitrate to nitrite.*

  So, False –ve results occur with infection with enterococcus, or other organism that do not produce nitrite. *(You have to understand the limitation of test)*

- Leukocytes
  - *Most of time if it is UTI, WBC will be MORE than 5, & the severity increase with increasing in No. of WBC's*
  - Threshold is 5 to 15 WBC/HPF

- Microscopic examination of the spun urine sediment
  - RBC (< 5)
  - WBC
    - It indicate inflammation, *which can be:*
      - » UTI.
      - » Glomerulonephritis.
      - » Interstitial nephritis.

- Significant Bacteriuria $\geq 10^5$ colony forming unit/ml
  - *It is considered quite significant, but if Pt has even 10^3 CFU/ml with classic symptoms, it is still significant as UTI*

Case I

75 Y female with incidental finding of bacteriuria of $\geq 10^5$ during routine out patient visit for her annual check up. She denied any genitourinary symptoms.

– What would you do?

a. Treat with antibiotics only
b. Treat with antibiotics and refer to urologist to exclude other pathology.
c. No treatment
d. Repeat culture in 4 weeks to confirm diagnosis

Case II

35 Y female with incidental finding of bacteriuria of $\geq 10^5$ during routine 10 week antenatal visit. She denied any genitourinary symptoms.

– What would you do?

a. Treat with antibiotics only
b. Treat with antibiotics and refer to urologist to exclude other pathology.
c. No treatment
d. Repeat culture in 4 weeks to confirm diagnosis

☑

In both clinical scenario, Pt with significant microbe in urine & no symptom at all this what we call it **Asymptomatic Bacteriuria**.

Asymptomatic Bacteriuria

- Two separate clean void with bacteria ≥ 10^5 colony forming unit/ml of the same pathogen with absence of symptoms.

  less frequent in young men & women but common in elderly.

- 5% of young adult and 53% of elderly women.
- Rare in young and 37% of elderly men. *(because of BPH)*
- Generally benign condition *(no need for treat or investigate).*
- Treat it in: *(Exception)*
  - Pregnant women.
  - Renal Transplant.
  - Pre-urologic interventions.

N B

Why we treat Asymptomatic bacteriuria in pregnant women?

- ▸ Because gravid uterus have some elements of hydronephrosis & it is more common in Rt. Side than the left.
- ▸ There is also some urethral dilatation related to gravid uterus & hormonal changes.
- ▸ Asymptomatic bacteriuria in pregnant women much more progress to pyelonephritis.
- ▸ So, more morbidity & mortality which can cause abortion, intrauterine growth retarded & intrauterine death

Because all of that, we treat pregnant women.

UTI in Pregnancy

- Screening for asymptomatic bacteriuria is standard practice at the first prenatal visit.
- There is ureteral dilatation during pregnancy due to:
  - Hormonal effects.
  - External compression.
- Treatment
  - Duration: Single dose?
    - 3 days
  - Choice: **No fluoroquinolone**
    - *One of common antibiotics to treat UTI but not used in pregnancy.*

Remember: You should ask women if she is pregnant by asking of delay menses.
& if you are still suspecting pregnancy, do pregnancy test.

Case III

A 24-year-old woman complaining of burning pain when passing urine and frequency. Her symptoms started 4 days earlier on the last day of her honeymoon.

What is the most likely diagnosis in this patient?

It is simple uncomplicated cystitis ☑

- She is young female with classic symptom.
- Most of UTI in young female are related to sexual activity.
- One of the theory states that "there is lower urethral colonization of bacteria. So, during sexual activity little amount of urine in urethra going back to bladder & induce infection."

Acute Uncomplicated Cystitis in Young Women

- Dysuria, frequency, urgency, and/or suprapubic pain.
- Pyuria always present
  - – Hematuria is common.
- Bacteriuria $\geq 10^5$ in MSU
  - – No need for routine C/S *(culture)*
  - – *For simple cystitis. Just do urine analysis.*

Treatment

In our community we are abusing antibiotics, So:

- E.Coli now is resistant to ampicillin. *(So, chose something else)*
- Three-day regiment are recommended.
- Antibiotics:
  - **Fluoroquinolones** for 3 days
  - **TMP-SMX** for 3 days
  - **β-Lactam**: Cefixime, Cefuroxime for 3 days
  - **Nitrofurantoin** for at least 7 days
  - Single dose **Fosfomycin**

- Routine post treatment cultures are not indicated.
  So, no culture before or after if symptom is gone

Differential Diagnosis of UTI

- Vulvovaginitis.
- STD *(Sexual Transmitted Disease).*

  - How to differentiate ?

    - Cystitis is sudden in onset and produces multiple symptoms (Dysuria, urgency, frequency).
    - The presence of hematuria strongly suggests UTI.
    - Vaginitis have other symptoms (discharge, vaginal odor, or dysparunia)
    - Symptoms with her husband.
    - Signs of cervicitis.
    - Missed periods.
    - *In STD, the vaginia & cervix are inflamed & sharing symptom with her husband . This is one way to diagnose STD.*

Recurrent UTI

- Common in women. *(as we said 1/3 of women will have recurrent UTI)*
- No evidence that recurrent UTI leads to health problems (HTN or CRF), in the absence of anatomic or functional abnormalities of the urinary tract. *(So, its benign condition not like pyelonephritis)*
- Most represent reinfection rather than relapse *(the same environment, rectal flora migrate into wet area & colonizing there & causing infection)*
- Many cases are caused by initially infecting strain persisting in fecal flora.

Prevention Strategies

- Contraception
  - limitation of the usage of spermicide-containing products.
- Post-coital voiding and liberal fluid intake *(emptying her bladder before & after sleeping with her husband.)*
- Cranberry juice. "التوت البري" *(if you consuming 2 glasses/day it will reduce UTI.)*
- Antibiotics *(the most effective way):*
  - Antimicrobial prophylaxis is highly effective
  - *We called it recurrent that deserve antibiotics as prophylaxis if she get* ≥ 3 infections over a 12 month period
  - Try for 6 months

NB

- Most of episode related to sexual activities e.g. if her husband comes in weekends she takes antibiotics in weekends.
- The prophylactic dose is 50% lower than treatment dose. E.g. we give ciprofloxacin 500 mg twice daily to treat but we need 250-500 mg once daily as prophylaxis.

Case IV

A 34-year-old lady presents to you with a two-day history of dysuria, frequency, urgency, back pain and shivering. You send a mid-stream specimen of urine to the laboratory. It is examined under the microscope where it is noted to contain many pus cells and bacteria.

- What is your diagnosis?

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–**Pyelonephritis** "there is back pain & shivering. It is not simple cystitis.

- Differential diagnosis?
  - Pyelonephritis not the only thing that causing these symptoms especially in this age.
- Management?
  - Either Inpatient *or* Outpatient
  - Either IV *or* Oral antibiotics

Acute Pyelonephritis

Clinical feature

- Ranging from mild illness to a life-threatening condition *(septic shock).*
- Flank pain.
- Nausea/vomiting.
- Fever (>38°C) strongly correlate with the pyelonephritis.
- Costovertebral angle tenderness.

Diagnosis of Pyelonephritis

***Remember**: In urine analysis, if there is no WBC, it is not pyelonephritis.*

- Pyuria is present in virtually all women
  - absence strongly suggests an alternative diagnosis
- Eighty to 95% of pyelonephritis are associated with $>10^5$ cfu/ml of bacteria
- Blood cultures are positive *ONLY* in 10 to 20%
- *No need for* Imaging studies (U/S & IVP)? *Except if Pt is:*
  - Male, complicated, or suspecting 2ry causes *(renal stone or colic)*
- Urine culture and Sensitivity *(send for culture)*

Differential Diagnosis for Pyelonephritis

- Pelvic inflammatory disease
- Appendicitis *(flank pain, urinary symptom & fever)*
- Ectopic pregnancy *(lower abdominal pain & urinary symptom)*
- Ruptured or torted ovarian cysts *(young girls are prone to many infection)*

TREATMENT

- Inpatient vs. Outpatient?

  Indication for inpatient (i.e. admission):
  - *Persistent vomiting leads to* Inability to maintain oral hydration or take medications.
  - Uncertainty about the diagnosis. *(admit for more investigation)*
  - Severe illness with high fevers, pain, and marked debility.
  - Pregnancy. *(to ensure they respond to antibiotics because they are at risk of abortion)*

- Antimicrobial
  - *The ideal way is to send sample to microbiologist to identify the sensitivity of microbe.*
  - susceptibility profile of uropathogens
    - *90% of E.coli are resistant to amoxicillin. So, do not use it.*
  - Oral agent:
    - **Oral fluoroquinolone**:
      - **Ciprofloxacin** (500 mg PO BID)
      - **Levofloxacin** (250 to 500 mg PO QD)
      - **Gatifloxacin** (400 mg PO QD)
    - **Trimethoprim-sulfamethoxazole** *(TMP-SMX)* or other agents can be used if the infecting strain is known to be susceptible

    - If enterococcus is suspected (Gram +ve cocci on Gram stain of urine), amoxicillin (500 mg PO TID) should be added to the treatment regimen until the causative organism(s) is identified *(one for gram –ve & other for gram +ve)*

NB ▸ No need to wait the culture results, start the treatment & then adjust it according to the result.

  - Parenteral therapy:
    - Ceftriaxone (1 gram IV QD) which is an effective and inexpensive agent.
    - Aminoglycosides (3 to 5 mg/kg) given once daily are cost effective
    - Ciprofloxacin, ofloxacin, levofloxacin and gatifloxacin *(very expensive try to avoid it)*
    - If enterococcus is suspected:
      - Ampicillin (1 to 2 g IV Q6h) for gram +ve plus gentamicin (1.0 mg/kg IV Q8h for gram –ve.
      - Piperacillin-tazobactam (3.375 g IV Q8h) (cover both gram +ve & -ve.)
  - **Switch to oral therapy once patient is not vomiting, afebrile & hemodynamically stable**.

- Treatment duration *(for pyelonephritis)*
  - – 14 days.
- Post treatment follow up:
  - – Asymptomatic: *(classic age & scenario)*
    - no need for post-treatment cultures.
  - – *But if it is* Recurred (+ve C/S *"culture"* in 2 weeks) *&/or he is man we will do:*
    - U/S or CT.
    - Re-culture.

- Urologic evaluation *(i.e. surgical evaluation)*:
  - – Indications
    - Recurrence of UTI (2 episodes in female)
    - Male
    - Not responding to initial treatment *(still febrile after antibiotics)*
    - Obstruction, Stones

Usually go with:

- – Ultrasound
- – CT scan *(occasionally)*
- – IVP or Cystoscopy *(rarely)*

Case V

76-year-old patient who has been catheterised for two months following a CVA. The patient is asymptomatic and apyrexial, but a nurse on the ward submits his urine for culture because it is cloudy and foul-smelling. The culture was positive for mixed organism.

How would you manage this patient?

a. Start a broad spectrum antibiotics
b. Do an U/S of kidneys to R/O obstruction
c. Repeat his urine culture
d. Observe for now

☑

We are dealing with UTI associated with indwelling bladder catheters
Urine has foul smelling but that was just colonization. Just get rid of folly cath.

UTI associated with indwelling bladder catheters

- *After inserting a folly cathertar, the incidence of UTI is increase by* incidence **3-10% per day** of catheterization
  (So, after 10 days all Pts will have colonizations)
  - Duration is the most important factor
- Most episodes are asymptomatic
- Symptomatic infections are polymicrobial *(not classical E.coli)*
- Treatment:
  - Avoidance of folly cath when possible
  - Intermittent instead of long-term indwelling catheter
  - Suprapubic catheter
  - Prophylactic antibiotics are **generally not recommended**
    - Except in Urologic surgery, Pregnancy

Cont'd

.: Renal Diseases in Tuberculosis :.

Renal Disease

- TB can affect kidney in many different ways.
- Direct infection of the kidney and lower urinary tract.
- Secondary amyloidosis *(when dealing with chronic infection, it will cause secondary amyloidosis "one of most common organ involved is kidney").*
- Nephrotoxicity induced by antimicrobial agents *(anti tuberculus drug causing acute interstitial nephritis).*
- Hyponatremia *(with TB due to inappropriate secretion of ADH syndrome).*

Direct infection

- Hematogenous seeding at the time of primary pulmonary infection
- Formation of granulomatous lesions in the glomeruli and interstitium *(heal with scar & fibrosis)*
- Similar lesions can occur in the ureters, bladder, and, in males, the prostate and epididymis. *(when it heal, it cause an obstruction)*

Clinical Presentation

- Usually insidious
- Dysuria and gross hematuria are the most common symptoms.
- Less common:
  - Renal colic
  - Fever, weight loss, cough, hemoptysis *(classic TB symptoms)*
  - Incidentally finding of pyuria and/or microscopic hematuria

Diagnosis

- The urine is classically **sterile** by routine culture with pyuria
  - – *When you send a urine sample for culture, they will do routine culture not for acid fast bacilli & it will be –ve .But in urine analysis, there will be 20-30 WBC, then send it for culture it will be –ve ,also.* ***This what we called it*** **sterile pyuria.**
  - – *Differential diagnosis for sterile pyuria are: TB , GN, interstitial nephritis)*

- Confirmation of the diagnosis requires the demonstration of tubercle bacilli in the urine
- **Urine culture is the gold standard** for establishing the diagnosis.
  - – *Very difficult to culture it from urine sample. So, send* three to six first morning midstream specimens should be sent to maximize the likelihood of a positive result

Treatment

- Appropriate treatment with anti-tuberculous agents is successful in eradicating active infection in almost all patients.*(classic way to treat Tb)*

.: The End :.

Done By *: Nephro Team*

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